JOINT MANAGEMENT PLAN REVIEW
DRAFT ACTION PLAN:
Coastal Development: Coastal Armoring

REVISED: March 14, 2003

***Please Note**: The MBNMS and the Sanctuary Advisory Council have tasked the management plan working groups with development of draft action plans that characterize the issue or problem and identify strategies and activities that address the issue. The working groups will develop these strategies and activities as they meet over the next several months. With this goal in mind, the progress of the group, the decisions, areas of agreement will be outlined in a progressively developed action plan identifying draft goals, issue characterizations, and strategies and activities. Members of the group as well as other interested parties should look to this draft action plan as it develops as a way of tracking the group's progress and decisions.*

Introduction

About 85% of the California coast experiences active erosion due to natural, and anthropogenic causes. Storm damage continually erodes away at the coastline, most notably during El Niño years such as the 1982-83 episode, and other heavy storms [1]. This ongoing erosion, which is largely a natural occurrence, presents a threat to coastal development that has occurred in vulnerable areas affected by these processes. The construction of hard surfaces such as concrete, covering large portions of land, impedes the natural absorption of water, thus exacerbating the problem of surficial erosion on adjacent unprotected land. Furthermore, in some areas, natural sand transport to the coast has been decreased through the damming of streams and rivers. Increases in coastal development also have led to storm-related damage. A 1992 study by Griggs, Pepper and Jordan estimated the cost of storm related damage and erosion, as well as structures used to mitigate the destruction throughout the state of California, at an average of $100 million per year [2].

In response to these issues, shoreline protective structures have been used extensively along California's coastline to protect the coast from wave action, or to retain soil to avoid erosion. Such structures have typically been installed by private landowners or local, state, or federal governments, in an attempt to protect development that is threatened by erosion. Structures have also been installed in response to the need to protect public infrastructure such as Highway 1, which in some stretches, is vulnerable to erosion related to bluff retreat. This practice is commonly known as *coastal armoring*, and includes seawalls, bulkheads and revetments. Vertical structures are either *seawalls* or *bulkheads* depending on their purpose. A bulkhead is used as a retainer, providing protection and stabilizing the land that it supports. Conversely, a seawall is normally a

bulkier structure designed for the purpose of wave interception. *Revetments* are protective structures placed along slopes and are constructed of a sturdy material such as stone [3]. With increases in development and continued, natural erosion of coastal bluffs, additional pressures will come to install structures both to access the coast and to protect both private and public property from erosion.

The Army Corps Of Engineers conducted an assessment of coastal armoring in 1971, and found that 3 miles of a study area spanning the coastline between the Santa Cruz/San Mateo county border, and Point Lobos in Monterey County was armored (all in the City of Santa Cruz). By 1978 armoring had increased to 9.6 miles, and by 1993, 12 miles was protected by structures. The California Coastal Commission estimated in 1995, that if trends continue, there would be as much as 27.7 miles of coastal armoring in the same area, in the future. The commission stated that although only one-eighth of the study area was armored in 1995, one-third of the coastline has the potential to warrant future protection when considering land use patterns, and physical characteristics [4].

Statewide, around twelve percent of the coastline (130 miles) was armored by 1998. The mid and late 1980's was a period when a large amount of shoreline armoring was installed – in response to the 1982/83 El Niño and the major storms that occurred in 1986 and 1988. Between 1985 and 1990, forty-five miles of armoring was installed, costing an average of $1,500 per foot ($60 million/year) [62]. By 1998, California residents were paying on average, more than $75 million per year to armor the shoreline [5]. In a study conducted by Griggs et. al., in 1992, it was determined that ocean front development has continually occurred in California, in the face of a large amount of scientific evidence regarding the risks of erosion. The authors concluded also that there was a large degree of inconsistency among existing state and local policies in addressing coastal hazards, and that there was a significant economic and local political influence shaping these policies[2].

Development has been allowed to occur in vulnerable areas along California's coast and there is a subsequent desire to protect both private and public property and infrastructure. The situation presents a serious predicament to both resource managers and property owners. However, it is clear that current policies need strengthening, and that there is a need to develop collaborative approaches to address the issues of erosion and the demand for coastal armoring, including improved guidance to enable better decision-making.

Impacts of Coastal Armoring:
Environmental impacts of coastal armoring are both site specific and cumulative. As the effects vary significantly depending on the type of structure constructed, and magnitude of the project, and the specific geological, biological, and oceanographic conditions in the vicinity of the structure the impacts of an individual project need to be evaluated on a case-by-case basis. Coastal armoring can potentially damage or alter local coastal

habitats, deprive beaches of sand, lead to accelerated erosion of adjacent beaches, hinder access and present problems with public safety.

As with any activity that alters natural processes, there can be significant long-term impacts related to coastal armoring. Armoring of the coast can interfere with littoral transport, which in a natural state may reach a dynamic equilibrium. Currents, waves, and wind normally transport sediment, which is supplied at a particular site. When the availability of sediment is reduced due to the existence of a structure, erosion can increase in other nearby locations. This is due to starvation of the materials that would normally supply these areas. When a structure is constructed, a supply of sediment is effectively being cut off. Armoring also causes deflection of wave energy, which can lead to accelerated erosion of nearby sites, which may subsequently require armoring structures. Thus, in many cases installing coastal armoring begets more coastal armoring. Furthermore, armoring can result in the loss of beach and intertidal areas through a process that has been termed "passive erosion." Areas undergoing long-term net erosion experience a natural landward movement of the entire beach system during periods of sea level rise, such as has been the case for approximately the last 18,000 years. As cliffs and sand dunes retreat, the vacated area becomes part of the beach environment and the position of the beach shifts landward. Building a protective structure in front of a cliff or dune temporarily stabilizes the location of the cliff or dune edge, however beach erosion continues. Since no new beach area is created through cliff or dune retreat, a net loss of beach area occurs. Ultimately, as sea level rise continues, this process also will result in the loss of the intertidal zone, as waves impact the seawall at all times, low tide as well as high.

Vertical structures in particular can deflect wave energy causing increased erosion and altering natural habitat in front of the structure, although some studies seem to indicate that this erosion occurs primarily during major winter storms and is temporary. Reflected wave energy may make it difficult for organisms to inhabit the area because of high turbidity. Erosion caused by the reflection of wave energy is more severe with vertical structures than with curved, stepped, or inclined structures, which absorb or disperse the energy of the waves [3]. Seawalls can have recreational impacts as well, by blocking both vertical and lateral access to beaches, and altering wave patterns, which can negatively impact surfing conditions.

Potential biological impacts of coastal armoring include changes in abundance and distribution of species. Depending on materials used, coastal armoring structures can influence the structure of benthic communities, due to potential differences in settlement patterns for natural substrates and armoring structures. Armoring structures can encroach into the intertidal, or disturb important buffer areas such as marsh habitat between the marine and terrestrial environments, which naturally mitigate erosion, and play an important role in flushing of certain contaminants. [3]. Certain structures can also provide habitat for predatory species not normally associated with the beach and intertidal zone

such as rats and squirrels, which can feed on intertidal organisms, compete for food with native species, and transmit disease. Additionally, coastal armoring can act as a barrier to wildlife, by blocking access of certain species to the beach.

With appropriate mitigation, environmental impacts that occur during the construction phase of coastal armoring projects are generally short term, lasting only a few days to a few weeks. Problems include increased turbidity caused by suspended solids in the immediate vicinity of the construction site, and the risk of chemicals or other materials entering the ocean from construction activities. Structures constructed in the intertidal zone have more impact than those constructed above the high tide line. Certain types of structures such as riprap revetments have fewer initial impacts than other hard structures, since construction normally requires significantly less excavation than, for example, a seawall. Permanent impacts of revetments however, are similar to those of seawalls, and the footprint of the revetment is typically larger. Mitigation measures include scheduling of the construction phase to reduce impacts by considering animal migration patterns, spawning patterns, etc, and specific actions such as the use of a silt curtain.

How is MBNMS Currently Addressing Coastal Armoring?
Sanctuary regulations prohibit alteration of the seabed, and all armoring structures placed below the mean high tide line require approval from the MBNMS. The Sanctuary regulates coastal armoring by authorizing California Coastal Commission permits, and issuing specific conditions on those permits, to minimize impacts to Sanctuary resources. Many additional seawalls however, have been constructed with no notification to or authorization from MBNMS. Since 1992, MBNMS review of seawalls primarily focused on minimizing impacts from the construction process rather than long-term impacts from the armoring itself. A major focus of this Action Plan is to conduct long-term planning as to the consequences of coastal armoring and its affect on one of the Sanctuary's most treasured resources, its beaches, bluffs, and coastline.

MBNMS has reviewed and authorized Coastal Commission permits for seawalls, riprap or other coastal armoring projects at 16 sites since its designation. Only a portion of the total number of coastal armoring projects underway in the region came to the Sanctuary for review. Of these permits, six were issued for extension and/or repair of existing seawalls, four for seawall or revetment construction, two for road stabilization projects to prevent bluff erosion, two for replacement of rip-rap with seawall, and one for stabilizing and making additions to existing rip-rap. Eleven of these 16 permits were in Santa Cruz County, 3 were in San Luis Obispo County, and 1 was in Monterey County.

A NOAA response to a comment urging the Sanctuary to prohibit the construction of seawalls, in the MBNMS Final Environmental Impact Statement states: "Activities that require drilling into, dredging, or otherwise altering the seabed of the Sanctuary, or constructing, placing, or abandoning any structure, material, or other matter on the seabed of the Sanctuary are prohibited except as allowed under 15 CFR § 944.11 or exempted

under activities related to the maintenance of harbors. Seawall construction would not be allowed." This statement clearly indicates an intent to prohibit seawall construction that is inconsistent with current and past practices. Nonetheless, the regulations adopted for the Sanctuary allow Sanctuary management to allow development, otherwise prohibited, by "authorizing" other agencies' permits, such as the Coastal Commission. There are three activities that MBNMS regulations expressly do not allow a sanctuary manager to permit—oil and gas development, and designating new dredge disposal sites or new sewage outfalls. The express regulatory prohibitions for which permits cannot be issued do not include seawalls. Thus MBNMS staff have interpreted this response to comment in the context of the entirely regulatory framework set up in 1992.

Development along the coast increases the pressure to protect coastal structures with various types of coastal armoring such as seawalls, bulkheads and revetments to manage erosion. Approximately 14 miles of the approximately 290 miles of coastline is already armored in the MBNMS, and this figure is estimated to double if trends continue at current rates. In light of this situation, MBNMS staff recently initiated a joint evaluation of coastal armoring with the California Coastal Commission, to develop a more proactive, comprehensive regional approach, improve the current case by case permit system and strengthen coordination between the Coastal Commission and the MBNMS on coastal armoring permit review.

Goal Statement:
The goal of this workgroup is to devise a framework to minimize impacts to Sanctuary resources, from coastal armoring, while recognizing the issue of protecting public and private property.

Potential Management Strategies:

The Sanctuary will work with its partners in implementing the following strategies and activities. While some of the items may be carried out solely by the MBNMS, the majority represent collaborative efforts that will be implemented in partnership with the various agencies and organizations involved in coastal armoring.

Strategy I: Characterize the issue and determine information needs in the short term (less than two years). Identify existing information and data gaps, and compile and produce scientific data and evaluation tools:

Activities:

- Develop Sanctuary-wide map of existing coastal armoring sites and potential future site requests

- Quantify coastal bluff erosion rates, and shoreline change rates (CCC with NOAA Coastal Fellow)

- Identify potential preventative measures aimed at reducing the need for coastal armoring

- Compile or conduct regional evaluation of sand transport dynamics and beach nourishment

- Assess individual and cumulative impacts of coastal armoring on sand supply dynamics, marine biological habitats and ecosystems, and public access

- Develop regional integrated database and GIS layers showing land use types, parcels, coastal armoring locations, bluff erosion rates, bottom types, biological habitats, geology/geomorphology, etc. for use as a planning tool and for permit review

- Develop and implement a long term monitoring program, to quantify and compare the impacts of different types of coastal armoring structures, in various habitat types and conditions. Considerations for monitoring program include intertidal biological community structure, changes in beaches, wave refraction patterns, and impacts on sand budget

Strategy II: Develop a more proactive and comprehensive regional approach that minimizes the negative impacts of coastal armoring. Approach will consider short-term impacts throughout the life of the structure, including those related to construction and maintenance, as well as long-term cumulative impacts.

Activities:

- Establish a hierarchy, which provides guidance for preferred responses to erosion in different sub-regions which will include:

    1. *Use of preventative measures:* Identify and evaluate preventative measures aimed at reducing the need for coastal armoring. Considerations may include increased setback requirements, incorporation of a "no hard armoring" policy (possibly in covenants, codes, and restrictions) for situations when coastal agricultural land is converted to development, re-alignment of coastal roads and highways, and requiring new setback requirements to be established for demolition/rebuild projects in urbanized areas

    2. *Alternatives to coastal armoring:* Identify and evaluate alternatives to coastal armoring, including but not limited to: a) alternatives conforming to MBNMS regulations such as relocation of vulnerable structures, re-alignment of coastal infrastructure such as roads, bridges, and highways,

and control of surficial erosion through practices such as the use of native vegetation, and; b) alternatives not conforming to sanctuary regulations, including some sand supply strategies, and artificial reef structures

3. *Preferred types of coastal armoring:* In cases where armoring is deemed necessary, identify and evaluate the least environmentally damaging types of coastal armoring, including more natural alternatives for specific conditions and geographic locations, taking into account environmental, aesthetic and public access concerns.

- Develop guidelines for a sub-regional planning approach to coastal armoring—potential criteria could be: pristine or particularly sensitive areas where coastal armoring should be strongly discouraged or not allowed; urban zones which are already heavily armored and where efforts should focus on restoration and improved armoring techniques; and areas in-between where thorough case-by-case review and additional research is needed

- Identify appropriate planning sub-regions. Logical sub-regions might be only a mile or two in some urban areas such as Santa Cruz, but could range up to many miles for long stretches of rural coastline such as Big Sur. Criteria to consider in establishing boundaries include:

1. Biological sensitivity of habitats

2. Physical considerations to include: geological units; sediment sources and sinks; beach nourishment needs, and; shoreline orientation and erosion rates

3. Development pressures including: extent of existing armoring in area; potential for new armoring requests in area; types of structures to be protected and; level of development and infrastructure in area

Strategy III: Improve the current case-by-case permit system and strengthen coordination between the MBNMS and other agencies on coastal armoring permits:

Activities:

- Identify permit conditions and authorization criteria of the agencies involved in the regulation of coastal armoring

- Compare typical multi-agency seawall permit conditions, identify and discuss selected discrepancies, and where possible rectify discrepancies

- Incorporate MBNMS standard conditions into CCC permits, where necessary

- Develop system for MBNMS handling and level of involvement in small versus large projects, given severe staff constraints

- Develop criteria for full MBNMS review of selected projects based on overall footprint, location, and potential impacts

- Define threshold below which MBNMS does not individually review project, but relies on CCC permit review process to incorporate standard MBNMS conditions

- Improve sharing of project and permit information at early stages, for those projects that meet the threshold permit criteria for full MBNMS review

- Develop a program for maintenance and restoration of existing armoring, including "clean-up" of poorly maintained sites, for both authorized and illegal structures

    1. When maintenance is required, re-evaluate the need for protection. If required, ensure that the proposed method is the least environmental damaging, and that appropriate mitigation of environmental impact is implemented.

    2. Incorporate improvements in beach access and public safety into maintenance and restoration program

    3. In heavily armored areas where maintenance is necessary and appropriate, consider the potential for installation of a comprehensive, uniform structure to replace multiple individual structures

- Reduce the use of and need for emergency permits through better predictive erosion analyses, potential alteration of current guidelines regarding initiation of work, and more proactive regional planning. Consider urban or semi-rural areas where it is appropriate to either initiate the work earlier on or develop alternative solutions, before the site becomes an emergency.

- Develop a multi-agency enforcement program to include inspection of permitted coastal armoring structures, tracking/notification and corrective action regarding illegal structures, and removal of emergency structures that aren't permitted but remain in existence

- If warranted based on above scientific evaluation, develop an environmentally-sound sand supply program funded by coastal armoring applicants

- Develop a system for tracking new information and scientific findings as it becomes available, as well as strategies for updating and revising guidelines with this new information

- Investigate opportunities for and promote more adequate funding for agencies involved with coastal armoring

Strategy IV: Training and implementation of regional program:

Activities*:*

- Conduct needs assessment to determine best strategies for reaching target groups including: decision makers, agencies, coastal land owners, and coastal developers (investigate potential for collaboration with the National Estuarine Research Reserves Coastal Training Program workshops in conducting outreach and training programs)

- Give ongoing guidance to local, state, and Federal agencies, developers, and private property owners, to educate about regional approaches to addressing coastal armoring and promote guidelines

- Develop program for evaluating local and regional land use decisions where coastal development may negatively impact MBNMS resources

- Work with system of Local Coastal Program updates to improve existing policies, and incorporate these guidelines where possible

Citations:

[1] California Resources Agency. Draft Policy on Coastal Erosion Planning and Response and Background Material. March 2001.

[2] Griggs, Gary B., James E. Pepper and Martha E. Jordan (1992) California's Coastal Hazards: A Critical Assessment of Existing Land-use Policies and Practices, California Policy Seminar, University of California.

[3] US Army Corps of Engineers. Engineer Manual. Design of Coastal Revetments Seawalls, and Bulkheads. 1995.

[4] California Coastal Commission. ReCAP Pilot Project Findings and Recommendations: Monterey Bay Region. September, 1995.

[5] Griggs, Gary. 1998. California Needs a Coastal Hazards Policy. Coast and Ocean Magazine. http://www.coastalconservancy.ca.gov/coast&ocean/autumn98/a04.htm

.

[6] Monterey Bay National Marine Sanctuary Final Environmental Impact Statement/Management Plan. June 1992. Appendix F, Page 36.